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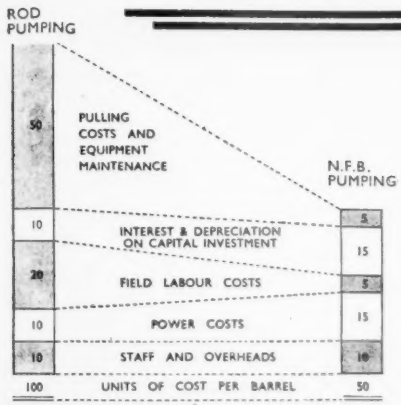

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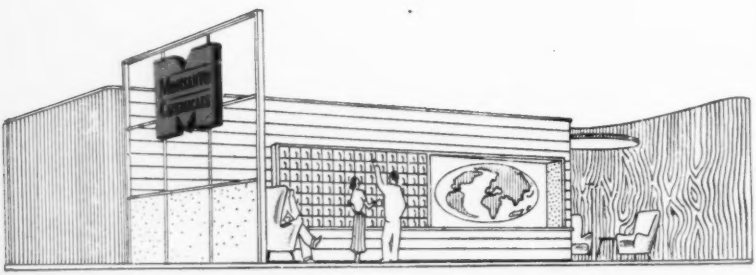

INSTITUTE OF PETROLEUM REVIEW

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INAUGURATION OF THE LONDON BRANCH

OVER 120 persons were present at Manson House on March 4, 1948, when the London Branch of the Institute of Petroleum was inaugurated. The chair was taken at the opening by Mr Hugh C. Tett (Chairman of the Council).

THE CHAIRMAN said: It is my privilege as Chairman of Council, and also my very great pleasure, to open the proceedings at this inaugural meeting of the new London Branch of the Institute of Petroleum. You will remember that before the war there was a quite active Students' Section in London, and an attempt was made to revive it in 1946, the war having then ended. I think most of us in the petroleum industry feel that we are students just as long as we are working in the industry and that we remain students irrespective of our age and experience. But the Institute has By-Laws, and in those By-Laws it defines what a student is within the Institute. It was found that in London there was a very small number of people after the war who were eligible under the Institute's Rules for membership of a Students' Section.

It was found, however, that there was a very large number of younger people in London who were interested in the kind of activities that had previously been handled by the Students' Section. It was also felt that, with the broadening of the interests of the Institute which took place in 1938, when the name was changed from "The Institution of Petroleum Technologists" to "The Institute of Petroleum," there was a need in London for some organization additional to the main body of the Institute, but of a rather different character from the pre-war Students' Section.

Those concerned put a very great deal

of thought into the problem, and discussions proceeded throughout the whole of last year amongst those members interested in forming a London Branch. Discussions also took place in the Branches Committee of the Council; and I am very glad that we have Mr Oriel, the Chairman of the Branches Committee, here to-night to address this meeting. Discussions took place in the By-Laws Committee, the Honorary Secretary of the Institute put a lot of work into it and the Council itself discussed the project on a number of occasions during 1947.

As a result of those discussions it was ultimately decided that the formation of a London Branch was desirable; and in December of last year ten members of the Institute sent a formal request to Council, in accordance with the By-Laws, that a London Branch of the Institute be formed. Council considered that request and considered some draft rules that had been prepared, and unanimously decided to approve the formation of the new branch.

Council confidently hopes and expects that the new branch and its activities will cater for a very large group of people in London, and that large numbers of young people connected with both the technical and non-technical sides of the industry will be attracted to it and will find it of great value. We on the Council have no doubt at all that the new branch will be a complete success. It will certainly have a very large number of people, engaged in the petroleum industry in the London area, from which to draw membership. I am told there are 300 to 400 oil companies with their head offices registered in London; so that, even if the new branch draws only one member from the head office of each company in the London area, the branch will be by far the largest in the Institute of Petroleum. I think it will probably do better than that.

All of us who are concerned with the formation of the branch are very anxious, of course, that the members who join it and who are not now Corporate Members of the Institute will find that the Institute is a good thing to belong to and will ultimately become full members of the Institute of Petroleum, whilst retaining their interest in the Branch through which they came to belong to the Institute.

I think you will realize from what I have said that a very great deal of work has led up to this inaugural meeting. Two people are mainly responsible for the work that has gone into forming this branch; it is their unfailing enthusiasm and hard work that has resulted in this happy event of the birth of a new branch of the Institute. Those two gentlemen are Mr A. J. Goodfellow and Mr N. E. F. Hitchcock. You will remember that Mr Hitchcock did very valuable work as Hon. Secretary of the Students' Section before the war.

With the authority of Council, Mr Goodfellow has acted as Chairman, and Mr Hitchcock as Secretary, of the Organizing Committee for the new branch, and I think they are both to be congratulated on their achievement ("hear hear" and applause). I should like to express to them in the warmest possible terms the appreciation of Council and of the Institute as a whole for all the work they have done.

I will now turn this meeting over to Mr Goodfellow, whom I will ask to occupy his rightful place as Chairman of this meeting.

MR A. J. GOODFELLOW, who, on occupying the Chair, was received with applause, said:

I should like first to express my appreciation to Mr Tett for his remarks in opening the meeting, and to the senior members of the Institute, to the Committee and to Mr Hitchcock for the valuable advice and inspiration which they have accorded throughout the last year in connexion with the setting up of this Branch.

Reference has been made by Mr Tett to the gap which we found existed between the facilities provided by the Institute and those required by the many members of the industry. I will not dwell on that because the reasons for setting up this Branch are obvious to us all; indeed, there are over 100 of them here to-night!

The purpose of the branch is to bring to its members information, enjoyment and a branch spirit. We shall hold meetings monthly and hope to arrange visits to various works and other places of interest. The lectures and papers will be of general interest rather than specialized, and we hope to include in our programmes discussions in which we can all join.

Rules have been set up provisionally which will ensure that the viewpoint of the younger members is put forward, and I do hope that we shall be able to arrange a programme which will suit and please the whole of our membership. And, of course, a branch is not a branch unless it has a social side, and we intend to foster a true branch spirit by the holding of social events.

Although the notice convening this meeting states that the election of officers will take place, it will be obvious that as we have only ten true members—the Founder Members—we cannot elect officers this evening. Thus, I am proposing that the election of officers be deferred until a later time, when we shall submit a list of members from whom candidates can be chosen. Application forms for membership are being prepared and will be sent out in due course.

You will probably want to know something about the subscriptions. We have in mind for this year, which is really only a portion of a year, that the subscription will be in the neighbourhood of 7*s*. 6*d*.

Already, through the offices of the provisional Organizing Committee, we have arranged part of the programme for the coming session, and the Committee will do its best to provide a varied programme for you until such time as elections take place and you choose your own committee and officers.

I would like to mention at this stage that there is in existence a journal, the *I.P. Review*, a periodical publication of the Institute, which particularly lends itself to branch activities. I hope that members of the London Branch will consider it of advantage to subscribe to that publication.

In introducing Mr J. A. Oriel, C.B.E., M.C., who is to address us on "Petroleum in the Modern World", I would point out that he, as Chairman of the Branches Committee, is the father of the branches—Northern, Scottish, South Wales, Stanlow, and Trinidad—and we have already experienced the benefit of his advice, his wisdom, and his support, which are always freely given. He is a very busy man; indeed, when we made an approach to him to ask if he would give an address this evening he was out of the country. Nevertheless, we had a prompt acceptance, and we do appreciate that very much.

MR J. A. ORIEL: In my capacity as Chairman of the Branches Committee I would like to add to what Mr Tett has said, to add my congratulations to the Chairman and Secretary *pro tem* for all the work they have done in building up this branch. From the attendance here to-night there is obviously a very strong need for a Branch in London, and we all feel indebted to the officers for the work they have done in bringing us together.

I am extremely conscious of the honour you have done me in asking me to read the inaugural lecture of the London Branch. Whilst there has been in pre-war days a Students' Section it has not heretofore developed into the full status of a branch. Indeed it is your own desire as well as the wish of the Council that this section should restrict its activities to lectures of a character

more suitable to a Junior Branch. This is for two reasons. Firstly, because it is felt that there is a great need for a forum where the younger members of the Institute can exchange views freely without the necessity of preparing lectures of a very formal and highly technical character. Secondly, because the parent body already exists in London and does already supply a meeting-place where all of us can meet and listen to lectures of a more advanced nature. Therefore, it is strongly felt that one should not run into any danger of the part absorbing the whole.

I was born and brought up in the Provinces and through the daily press was constantly made to feel the superiority of London. Although I am prepared to debate this point, nevertheless I cannot but be conscious of the honour you have done me as a Provincial in asking me to speak at the first meeting of the Metropolitan Section.

Mr Oriel then delivered an address on "Petroleum in the Modern World."*

MR A. W. DELLER (a member of the Organizing Committee for the Branch), proposing a vote of thanks to Mr Oriel for his Address, said:

In an industry so vast and so diverse as the petroleum industry very few of us have the opportunity to keep in our minds an overall picture of its activities. From that point of view the sort of address we have had to-night from Mr Oriel is extremely valuable. The technical picture is so divided normally, each branch of the industry is a branch for the specialist; but in Mr Oriel's address we have had a summary of the progress that has been made during the last 40 years from the technical angle. I hope that later on the marketing people will feel impelled to give a few of their ideas as to the products which the technical people produce for them to sell from time to time. I hope, too, that many of the suggestions which Mr Oriel has put up for future programmes will be put into effect, for they should provide most useful material.

Apart from the technical aspects, perhaps the most stimulating side of Mr Oriel's address was the economic; it will give all of us, concerned with both technical and marketing interests, a great deal to think about and will open up many new avenues of thought on the petroleum industry as a whole. I ask you to join with me in thanking Mr Oriel for a most interesting and illuminating address.

(The vote of thanks was accorded with enthusiasm, and Mr Oriel briefly responded).

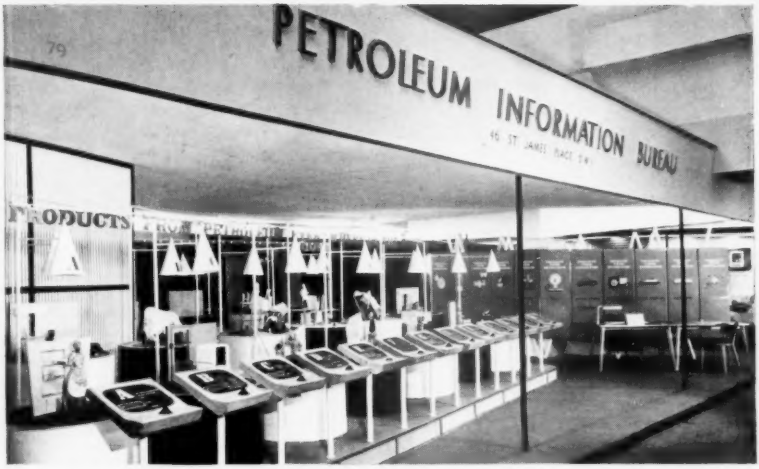
THE CHAIRMAN: Before closing the meeting I would like briefly to catalogue the subjects to be covered at future meetings of the London Branch. They range over the whole field of petroleum, including economics, commerce, marketing, transport and technology, and they will be dealt with from the technical and the non-technical points of view.

Membership of the Branch is open to all persons interested in the use of petroleum or its products. That definition is wide and covers Corporate Members, non-Corporate Members, and Students of any age; it includes also the gentler sex.

Since the inaugural meeting applications for membership of the London Branch have risen to over 250, and there is every indication of an encouraging spirit of enthusiasm for the Branch. Mr N. E. F. Hitchcock, *Hon. Secretary*, (c/o C. C. Wakefield & Co. Ltd.), Research Dept., Hayes, Middlesex, will be happy to supply full details of the Branch.

* This address will be published in our next issue.

Recently issued by the Oil Well Supply Co. is Booklet No. 2c-1047 which describes the company's rotary drilling tables. Those referred to have maximum table openings of 17, 20½, 21, and 27½ inches.



The stand of the Petroleum Information Bureau was designed by the Design Research Unit to demonstrate the uses of petroleum products in the home from "A" to "Z".

PETROLEUM IN THE IDEAL HOME

PRODUCTS of petroleum everywhere in the home was the theme of the stand occupied by the Petroleum Information Bureau at this year's *Ideal Home Exhibition* at Olympia, London. On the stand itself were models illustrating the widespread uses of oil in the modern way of living. Tablets lettered from A to Z described some of these uses, while the pressing of a switch caused the appropriate model to be illuminated. Visitors were also provided with an

A general view of Chapters 1 to 4 of The Petroleum Story *as told by the M.O.R. group of companies on their stand designed by James Gardner, O.B.E.*

attractive folder illustrating how petroleum enters into all kinds of domestic needs from providing bitumen for paths to ingredients for cosmetics, from gramophone records to insect sprays, or from medicinal paraffin to roofing felt.

On another stand the M.O.R. Group of companies combined with Petrochemicals Ltd., to tell "The Petroleum Story", with the object of bringing home to the maximum number of people the increasingly important role the oil industry is playing in Britain. The story was told in five chapters, each consisting of murals, photographs, dioramas, etc. Chapter I was devoted to *The Beginning of Petroleum*, Chapter 2 to *Tapping the Reservoirs*, Chapter 3 to *Oil Goes to Market*, Chapter 4 to *Petroleum Refining Today*, and Chapter 5 to *Petroleum 1948*, this last being divided into two sections, *A British Oil Refinery* and *Chemicals from Petroleum*. Thus the visitor was able to gain some impression of the history of mineral oil from its origin to the world of to-day and to see its modern applications massed in a final display, ranging from nylons and plastics to pharmaceuticals and photographic chemicals.

In the Garden Section of the Exhibition the theme of an interesting stand by Shell Chemicals Ltd. was health in the garden and the home. Here one was introduced to a full range of sprays designed to protect crops against pest and disease. These insecticides and fungicides are available to the small user in convenient form, as also is the apparatus for distributing them in the most effective manner. A useful series of technical information sheets on the various washes and sprays were also available. On one part of the stand the housewife was able to see how attractive her kitchen was from the fly's point of view.

Garden sprays for use throughout the year and how to make the home less attractive to the housefly were exhibited by Shell Chemicals Ltd.

Preliminary figures give the production of crude petroleum in Canada in 1947 as 7,632,204 brl compared with 7,585,555 brl in 1946. Natural gas output in 1947 is similarly given as 53,310,382 M.cu.ft., against 47,900,484 M.cu.ft. in 1946.

FILMS AS INTERPRETERS OF THE PETROLEUM INDUSTRY

An Address by SIR STEPHEN TALLENTS, K.C.M.G., *to the Oil Industries Club.*

Mr G. H. Coxon, President of the Club, introducing Sir Stephen, said: "Sir Stephen is very well known in connexion with his work on the Empire Marketing Board. It came out with a blaze of advertisements and good films on a large number of subjects, which attracted the attention of people in all parts of the world. I think it was an outstanding example of publicity.

"We are in an era where publicity and public relations are very much to the fore, not in the sense of advertising, but of bringing to the notice of all classes of people, including the working man, the ramifications and complexities of industry, and how industry is serving the people. Many of us in our own industry feel that we are not giving sufficient attention to the publicity side of our business. We feel that in our industry we are doing good work, but that very few people know of the ramifications of the industry, that very few people realize what the great oil companies do in the way of development and research, and in connexion with the housing of the people, the cinemas, the schools, the hospitals, and so on. I am quite sure that Sir Stephen, with his very wide knowledge, will be able to indicate how our industry, and industry generally, can let the people know what is being done. There is nothing of which we are ashamed. America is doing it a great deal, and I do not see any reason why we should not also."

It seems to me that from the growth of scientific research, which the ordinary man cannot understand; from the specialization within industry, which means that nowadays, much more than of old, a man will do a piece of a job without knowing what is being done about it elsewhere; from the growth of education, which makes people inquisitive and anxious to learn about things, and from many other causes there has developed a demand for a new interpretative process which shall speak in new terms and bring together, for instance, the two ends of the industrial scale, the consumer and the producer, and, within industry, bring the producers themselves together.

It often strikes me that anybody who goes to prepare a road, an airfield or an oilfield, and so on, takes the most elaborate pains beforehand to plot out what he will do and how it will be done, whereas on the other hand this great job of interpretation is ordinarily done without any comparable advance planning, and indeed, often shoddily and expensively. There is a great contrast; but I suggest that it is just as important to plan for the traffic of men's ideas as for the traffic of the railways, the aeroplanes and the other vehicles which move men's bodies about the world. After all, it was stated in the Charter of U.N.E.S.C.O. that, since wars begin in the minds of men, it is in the minds of men that the defences of peace can be constructed. There is the challenge. There should be a proper planning and carrying out of what used to be called "publicity", and is now sometimes called "public relations", but which for the purpose of this talk I will call "interpretation".

Things have advanced a good deal in that field since the day when in America, where most of the work began, Mr Harry Reichenbach, in order to advertise a film called "The Virgin of Stamboul", employed men to go round the

hotels of New York, asking for a missing virgin called "Sari."

Nowadays, if you go in for publicity, you must harness something like an orchestra. There is the Press, the written word; and I do not yield to any in my sense of the importance of what the Press can do. But my brief is to talk about films; so that I am more concerned with the visual side. I could make out a case for visual media other than the films, for I have operated most of them in my time—the exhibition display, the shop window display, the poster, the model, and so on. I think that one of the lessons we have learned since I was thrown into this job as a Government servant twenty years ago is the importance of the eye. I have read recently in the report of a broadcast talk, that three out of every four people in Britain are more susceptible to the appeal to the eye than to the appeal to the ear, more susceptible even than they are to reading. I think I am myself; and when we come to illiterate people, I imagine the pictorial appeal is almost essential.

Among the forms of visual appeal the film is often the most exciting. There is movement. According to an American Department of Commerce estimate, 235 million people in 1939 were going to see the films every week. People are film-minded, and in consequence they pick up points very quickly from the films. We may be proud that the English documentary film movement is the most advanced in the world; that is a national asset of which I should like to see continued advantage taken, as advantage has been taken of it in recent years.

Films, too, produce a very useful by-product in the form of film strips, and of 'stills' which can be used in all sorts of publications.

The growth of television obviously has a bearing on the importance of films. I was looking-in last night. Two new services have been started, one a newsreel specially produced for television, and the other a sort of magazine with serious talks about different industries. I was led to think of the new importance which attaches to the film by reason of the growth of television.

I was led, too, to reflect on what I regard as one of the principal targets for films, namely, their internal usefulness. One has to consider what are the audiences to which a film can appeal. There is the obvious external audience of the public at home, to whom one wishes to make one's job or one's industry of interest. There is at the same time the target to which, from my own experience, I have come to attach special importance, namely, that of making one's own colleagues or workpeople feel that they are engaged in doing something worth while and that the value of what they are doing is recognized by the public. I had an experience in that connexion at the Post Office when we came to make films bringing alive the jobs of men who ordinarily work, year in and year out, in obscurity. I think the effect upon those great unseen staffs of showing the public what they were doing, of getting the public to appreciate the fidelity of their work, was of even more value to the Post Office than the advertising we did of the Post Office services like the telephone. On the television screen last night a miner said with great feeling that only now, after the 27 years in which he had been working at the coal face, had the miners been able to feel that the public knew something of what they were doing. I believe that this internal effect of publicity upon one's own staff is very important.

Then there is another internal aspect of publicity. In these days, when people are engaged on highly specialized jobs in industry, it is a great thing to show them the other operations with which their work is combined and which they may otherwise never see. There must be, in the groups of industries which you represent, opportunities of showing how products are developed by team work

and how the essential machinery is produced. A man becomes more efficient if he has an idea of the background of which his work is probably a fragmentary part.

There is also the scientific side. Surely the film is an important medium for showing, abroad if necessary, or to technical students and to fellow scientists engaged in research, what is being done. There is the further point that, by showing that kind of work, you encourage recruits to the industry. I was going around the laboratories of a large oil company about a year ago. There obviously the recruiting of the best men for that particular form of research was an important matter. I doubt whether you could have a better recruiting agency than a film showing the work done and the conditions in which it is done; such a film could be shown to university students, to students in technical schools, and so on.

In your industry it is important to show the populations in the areas in which the oil is produced what is happening in their midst, what it all means; to indicate the attitude of the companies whose representatives are working among them. I am ignorant in many respects of your industry; but there must be in the more remote oilfields admirable opportunities for film production, in concert with the local governments if you like, to indicate something of the frame of mind in which the companies work and how that work benefits the countries in which they are working. That is another field in which the film has a proper and an important target.

The production of films, like the production of all publicity, is not an easy job. There are many pitfalls, and I have fallen into dozens. Rather than tell of my own disasters, however, I will relate a story which an American related to me. An American soap company produced a poster showing a young woman hanging out the washing on a line, whilst a baby was crooning at her feet. Only when the poster had been printed in about ten different colours and issued was it noticed that the young woman wore no wedding ring on her finger. The company explained that she had taken off her wedding ring in order not to lose it in the wash. They explained alternatively that she was able to wash so readily with their soap that she could mind her neighbour's baby at the same time. But still it was not good enough, and the posters had to be recalled in order to implant the wedding ring on her finger!

That is the sort of accident that always occurs in publicity, the sort of thing which should make any executive sympathetic when the film-makers come to him for help in their difficult job. You will appreciate that it is very difficult for them to go into an organization and to try to work up its public relations system. They look at things from a different point of view from that of the men who are doing their day-to-day job in the organization, and by no means always do they meet with the sympathy they feel they deserve. Therefore I plead that, if you fall among film-makers and other producers of publicity you should not be too hard on them!

There again I have a chestnut to illustrate my point. It concerns a man who was advertising dog biscuits. An agent produced an excellent picture, and underneath was printed "Dogs like 'em." The man who was selling the biscuits, however, was not having anything so simple and direct; he scratched out "Dogs like 'em" and substituted the words: "No more appetising and nutritious fare was ever offered to the canine tribe." (Laughter). That is not the way to sell dog biscuits. Little though one may like the portrait which a film may produce of an industry or a business in which one is interested, it is well to reflect that even in ordinary portrait painting the subject does not always like his own picture.

The oil industry has the opportunity to-day to do what I think no industry or group of industries has yet fully done, namely, using various media including the film to paint a picture showing the greatness and the variety, actual and potential, of the industry, and how those who produce, distribute and use oil, and those who by their researches or their manufactures contribute to those activities, go about their daily work. If your group of industries got together to produce such a picture and to put it before the public, at home and overseas, and before themselves, they would produce something which was extremely potent as a selling point, potent also, if you like, as a defensive point, for there is such a thing as defending great business operations nowadays. I do not overlook what is being done by the Petroleum Films Bureau. They had something like 15,000 showings last year alone. But there are not enough up-to-date films available in the oil industry at this moment to show what it all means. I have come to realize what an immense amount of material there is here—of human material, which is entirely overlooked by many people when they think of the oil industry, of engineering, of research, of development material, and so on. There is a wonderful story to be told, and I do wish that this group of industries would get together to tell it.

It is much easier to make a plan for doing it than to carry it out. I have had to plan publicity and—sometimes painfully—to carry it out, so that I am not speaking quite theoretically or without sympathy for those upon whom the carrying out would rest. But it would be a fine thing to see a British industry really illustrating itself and orchestrating its illustration. I am encouraged to throw out that hope by the very nature of this Club, which in itself represents many industries, bringing them together in so friendly, agreeable and hospitable a form as at this luncheon.

U.S. PETROLEUM AND NATURAL GAS RESERVES

THE Petroleum Reserves Committee of the American Petroleum Institute has reported that the proved reserves of crude oil in the U.S.A. on December 31, 1947, amounted to 21,487,685,000 brl which, with 3,253,975,000 brl of natural gas liquids, made a grand total of 24,741,660,000 brl of liquid hydrocarbons.

At the beginning of 1947 the crude oil reserves were estimated at 20,873,560,000 brl. Changes during the year were additions of 749,278,000 for revision of previous estimates, 1,269,862,000 for extensions of old fields, and 445,430,000 for new reserves discovered, making a total of 2,464,570,000 brl. After deduction the 1,850,445,000 brl produced during the year, the net gain in reserves was 614,125,000 brl.

Proved reserves of natural gas liquids on January 1, 1947, were 3,163,219,000 brl. With 192,237,000 brl for revisions and for extensions of old pools, plus 59,301,000 brl for new reserves discovered during 1947, less the 160,782,000 brl produced during the year, the net gain was 90,756,000 brl.

NATURAL GAS

The American Gas Associations Committee on Natural Gas Reserves similarly reports that reserves of natural gas in the U.S.A. on December 31, 1947, were 165·93 trillion cu.ft., an increase of 5·35 trillion during the year. This increase was made up of 7·57 trillion cu.ft. from revisions and extensions of old fields with 3·41 trillion for new discoveries, less production during the year of 5·63 trillion cu.ft.

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THE USE OF ACETYLENE IN GERMANY

By R. B. RANDALL*

ONE of the outstanding developments in the German chemical industry during the war was the extensive use of syntheses based on acetylene. It was recognized that some of these syntheses, such as those which had as their first step the catalytic reduction of the acetylene to ethylene, would probably not compete with more usual processes in times of normal supply, but the acute shortage of petroleum enforced the use of acetylene as a raw material. Thus a wide range of organic chemicals, plastics, drugs, adhesives, solvents, textile finishing and sizing agents, gums and oils was based on this starting material. It is the purpose of this article, which is based on reports on the German chemical industry, to outline briefly some of the syntheses that were developed.

In a previous article[22] it was pointed out that in 1936 German carbide production was about 1,000,000 tons, more or less equally divided between welding, cyanamide production and acetylene chemistry, which thus received the equivalent of a little over 100,000 tons of acetylene. By 1942 the acetylene produced for acetylene chemistry had risen to more than 300,000 tons for the year (including some 70,000 tons of acetylene produced by the arc process), and represented over one half of the carbide production. This enormous increase in the use of acetylene, besides leading to new and valuable ranges of plastics and intermediates, necessitated new methods of handling this highly reactive material.

For more than twenty years Dr J. Walter Reppe[1] of I.G. Farbenindustrie A.G. had been directing work on the investigation of the reactions of acetylene and consequent technical developments, and he, more than any other man, is responsible for the great interest shown in acetylene chemistry to-day. The syntheses of butadiene (and intermediates), vinyl ethers, adiponitrile and succinic acid from tetrahydrofuran, and acrylonitrile from acetylene by Reppe methods all reached a commercial stage, while many other very interesting syntheses were still in the laboratory or early development stage[1b]: the value of Reppe's work is not to be judged from the quantities of materials actually made by Reppe syntheses, but rather by his numerous contributions to the chemistry and technology of acetylene.

Besides developing new syntheses Reppe contributed much in devising safe conditions for handling acetylene[1a], thus making possible the technical application of the reactions involved. For instance, whereas acetylene under a pressure of 0·5 atmosphere had previously been considered dangerous, and pressures over 1·5 atmospheres forbidden by law, the manufacture of butinediol on a large scale involved the use of acetylene in the presence of copper acetylide at a pressure of 6 atmospheres and a temperature of 110° C.

Allocation of Acetylene in the German Chemical Industry

It is not easy to obtain from the reports on the German chemical industry a precise picture of the allocation of acetylene in chemical production in Germany during the war, or even to determine in some cases what stage of production a given process had attained. While the following figures must, therefore, be treated with reserve, they indicate some of the major products made by I.G. Farbenindustrie from acetylene during the year 1942[2]:

* Fuel Research Station, Department of Scientific and Industrial Research.

233,520 tons of acetylene (equivalent to about 72 per cent of the acetylene produced for acetylene chemistry in Germany in 1942) were converted to:

2,400	tons	of vinyl ethers
10,200	,,	of vinyl acetate
18,000	,,	of vinyl chloride
13,800	,,	chlorinated hydrocarbons
325,100	,,	acetaldehyde, which gave rise to the following major products:
	82,300 tons	butadiene (for Buna rubbers)
	27,140 ,,	ethyl alcohol (by-product in butadiene synthesis)
	26,300 ,,	butanol
	62,000 ,,	acetic acid
	36,000 ,,	acetic esters and salts
	21,500 ,,	acetic anhydride
	14,000 ,,	ethyl acetate
	11,230 ,,	acetone
	6,480 ,,	diethyl ether
	2,300 ,,	butyraldehyde

The plastics made from acetylene by the I.G. in the same year amounted to some 42,000 tons. In addition, some 2000 to 3000 tons a month each of crotonaldehyde (for butanol synthesis), trichlorethylene, tetrachlorethane and ethylene were made with acetylene as starting material.

Ethylene

One of the most surprising developments was the large scale production of ethylene from acetylene[3] by vapour phase catalytic reduction at 300°C, using a palladium catalyst. Five full-scale plants used this process at Schkopau, Gendorf, Hüls, Ludwigshafen and Auschwitz: the ethylene was used[4] for the production of ethylene oxide (for glycol and polyglycols for explosives), ethylene polymers (as lubricating oils), acrylates (via ethylene cyanhydrin), synthetic emulsifying agents, styrene (for Buna S), diethyl benzene (kybol), ethylene dichloride, etc. By September, 1943, of a total ethylene production in Germany of 9000 tons a month, one-third was from acetylene.

Acetaldehyde and Associated Chemicals

By far the greater part of the acetylene used in the German chemical industry was hydrated to acetaldehyde.[5] Acetaldehyde was of supreme importance in the production of artificial rubbers (Buna), butadiene made for this purpose accounting for approximately half of the acetaldehyde produced. The shortage of natural woollen and cotton fibre in Germany gave prominence to the cellulose acetate industry which had acetaldehyde as its chief source of acetic acid. The paint and lacquer industries also depended on this source for many of their solvents, such as butanol, butyl ether, butyl crotonate, acetone, ethyl acetate, etc.

The greater part of the acetaldehyde was synthesized by the classical process[6] in which acetylene was hydrated at 94 to 97°C, using a solution of mercuric sulphate in sulphuric acid as catalyst. The old discontinuous batch process involved the withdrawal of the spent catalyst (reduced to mercurous sulphate), its isolation, electrolytic oxidation and reconversion to mercuric sulphate, an expensive multistage process which was used only at Burghausen. An improved process was used in various developments at Knapsack, Hüls and Gendorf. In this, a mixture of mercuric and ferric sulphates was used as catalyst, and the reduced mercurous sulphate which formed was continuously oxidized by the ferric sulphate. The catalyst solution was continuously removed from the system, oxidized with nitric acid and recycled. This modification enabled the synthesis to be run as a continuous process, greatly reduced the loss of mercury (a considerable factor in the process) and the amount of mercury used, and decreased the cost of catalyst reoxidation. The acetaldehyde was condensed from the exit gases and concentrated by distillation.

Although the Reppe synthesis[7] of acetaldehyde apparently did not reach production scale, it had the advantage that it required no mercury—a scarce metal in Germany—and hence gave a mercury-free product very suitable, for

instance, for the production of acetic acid for cellulose acetate for photographic bases. It was also claimed to have practically the same production and capital costs as the mercury process. The first of the two stages involved was an example of the "vinylation" reaction, in which addition between acetylene and hydroxy-, mercapto-, amino-, amido- or carboxy-groups is brought about to give a vinyl derivative. Methyl alcohol and acetylene were allowed to react at 160°C and 16 atmospheres pressure in the liquid phase in the presence of caustic potash to give methyl vinyl ether. The ether was hydrolysed at 80 to 100°C and $2\frac{1}{2}$ atmospheres with dilute sulphuric acid, yielding acetaldehyde and methyl alcohol which was recycled.

$$CH_3OH + CH : CH \rightarrow CH_3.O.CH : CH_2$$

$$CH_3.O.CH : CH_2 + H_2O \rightarrow CH_3OH + CH_3.CHO$$

A total of about 30 tons of acetaldehyde was made in this way at Ludwigshafen.

No important advances were made in the manufacture of acetic acid, which was synthezised by the oxidation of acetaldehyde with oxygen at 60°C in an aluminium tower-type reactor using a catalyst of manganese and cerium acetates in acetic acid. At Knapsack this method was modified, by using cobalt and copper acetates, and a mixture of acetic acid and acetic anhydride, in the ratio 2 : 1, was produced.

A new process was developed at Hiag for the production of acetonitrile,[8] by the dehydration of a mixture of glacial acetic acid and ammonia over an aluminium-thorium catalyst at 500°C.

$$CH_3COOH + NH_3 \rightarrow CH_3CN + 2H_2O$$

The yield was 70 to 80 per cent of the theoretical, and the product, some 8 tons a month, was sent to Höchst for chlorination into the trichloro-derivative, a delousing agent known as "Tritox".

In the manufacture of acetic anhydride[9] the ketene process was generally used, in which acetic acid vapour is dehydrated to ketene by mixing it with triethyl phosphate and passing the mixed vapours through a coil at 600 to 700°C.

$$CH_3COOH \rightarrow CH_2 : CO + H_2O$$

$$CH_3COOH + CH_2 : CO \rightarrow (CH_3CO)_2O$$

The ketene so formed was absorbed in acetic acid-acetic anhydride mixtures in a series of scrubbers and the acetic anhydride finally concentrated by batch distillation. About 2 tons a month of the ketene so formed was polymerized to diketene for the production of acetoacetic esters, pyrazolones, etc.

A considerable amount of acetic acid was converted to acetone[10] using as catalyst cerium acetate on pumice at 400 to 500°C, the process giving a 96 per cent theoretical yield. While this process was used at Burghausen, Knapsack and Schkopau, at Ludwigshafen a Reppe synthesis was employed. In this, dilute acetylene from the arc process was directly hydrated to acetone at 400°C and atmospheric pressure, with zinc oxide pellets as catalyst, at the rate of 400 tons a month.

Ethyl acetate[9d] was made by the condensation of two mols of acetaldehyde in the presence of a catalyst consisting of aluminium ethylate (prepared from aluminium borings, aluminium chloride and ethyl alcohol). Apart from its main use as a solvent, about 150 tons a month was converted to acetoacetic ester by reaction with sodium ethoxide. The Reppe process, making the ester from diketene and ethanol reached pilot plant stage, but only attained an efficiency of conversion of between 30 and 40 per cent.

Aldol[11] was the starting point of a series of compounds, notably butadiene and crotonaldehyde. Two mols of acetaldehyde were condensed in the liquid phase (at 20 to 30°C), using caustic soda or potash as condensing agent, usually in large multi-tubular heat exchangers. The aldol was hydrogenated at 300 atmospheres at 50 to

150°C in a copper-lined reactor containing copper-chromium catalyst on silica gel, and the products were condensed and fractionated. The butane-1 : 3-diol so produced was then dehydrated by passing it with steam through a catalyst of sodium phosphate on coke at 280°C and one atmosphere pressure.

$$CH_3CHO + CH_3CHO \rightarrow CH_3CH(OH)CH_2CHO$$

$$CH_3CH(OH)CH_2CHO + H_2 \rightarrow CH_3CH(OH)CH_2CH_2OH$$

$$CH_3CH(OH)CH_2CH_2OH \rightarrow CH_2 : CH.CH : CH_2 + 2H_2O$$

Although the aldol process accounted for the greater part of the butadiene made in Germany an important alternative synthesis devised by Reppe[12] was used to the extent of 1500 tons a month and was about to be expanded. It was a three-stage process: (1) acetylene and formaldehyde were made to react at 4·5 atmospheres, 100 to 120°C using copper acetylide catalyst, to give 2-butine-1 : 4-diol, (2) this was hydrogenated at 300 atmospheres, 120°C, copper-nickel catalyst, to butane-1 : 4-diol, which (3) was finally dehydrogenated to butadiene at 1 atmosphere, 280°C with sodium phosphate catalyst.

$$2H.CHO + CH \vdots CH \rightarrow CH_2(OH).C \vdots C.CH_2OH$$

$$CH_2(OH).C \vdots C.CH_2OH + 2H_2 \rightarrow CH_2(OH)CH_2CH_2CH_2OH$$

$$CH_2(OH)CH_2CH_2CH_2OH \rightarrow CH_2 : CH.CH : CH_2 + 2H_2O$$

This route utilized available methanol, reduced the acetylene consumption, avoided the use of mercury, and was claimed to have an efficiency comparable with that of the aldol route. Moreover, it was a more versatile process; the butinediol could be used for the production of such chemicals as adipic acid and hexamethylene diamine; propargyl alcohol could be produced by a slight modification (increase in pressure and acetylene concentration) of the first stage, and was a by-product of the butinediol synthesis, and tetrahydrofuran by a modification of the final stage. Butanediol was also used on pilot plant scale for the production of polyurethane resin, by condensation with hexamethylene di*iso*cyanate, and some 40 tons a month of γ-butyrolactone were prepared from it by dehydrogenation over a copper catalyst at 230 to 250°C.

It seems doubtful whether any of the butadiene syntheses based on acetylene could compete with petroleum sources of this material or even with the Lebedev process based on ethanol: though the versatility of the Reppe synthesis, and the range of reactive materials it can provide, make it well worth attention.

Crotonaldehyde[13] was made at Höchst and Burghausen by batch distillation of a mixture of aldol and acetic acid through a copper column.

$$CH_3CH(OH)CH_2CHO \rightarrow CH_3CH : CHCHO + H_2O$$

The crotonaldehyde was largely converted to butanol by hydrogenation at 200°C in the vapour stage using copper on pumice catalyst, the butanol (90 per cent yield) being subsequently purified by distillation. Small quantities of butyraldehyde were made from crotonaldehyde by liquid phase hydrogenation at 25 atmospheres and temperatures below 30°C, using a nickel-pumice catalyst. Crotonaldehyde was also used for the production of some 50 tons a month of maleic acid[13b] by oxidation with air at 350 to 390°C over a vanadium pentoxide, molybdenum oxide, titanium oxide catalyst supported on pumice.

$$CH_3CH : CHCHO + 2O_2 \rightarrow \begin{matrix} CH.COOH \\ \| \\ CH.COOH \end{matrix} + H_2O$$

Vinyl Ethers and Esters

Vinyl acetate[14a] was produced by the direct union of acetylene and acetic acid in the vapour phase at 170 to 200°C over charcoal impregnated with zinc acetate. The largest production plant for this material was at Höchst, with an output of 850 tons a month. Some 15

tons a month of polyvinyl alcohol was made from polyvinyl acetate by treatment with methyl alcohol and sodium methoxide.

Vinyl chloride[14b] was made on a considerably larger scale than the acetate, by the direct union of acetylene and hydrogen chloride at 110 to 180 °C over a mercuric chloride-barium chloride catalyst supported on active carbon. The polymer was used for a great variety of purposes, both industrial and domestic, being readily coloured and highly resistant to oxidation and water. It has also, when suitably prepared, good electrical properties. In addition, some 5 tons a day of chlorinated polyvinyl chloride were made, by direct chlorination of polyvinyl chloride in tetrachlorethane solution, for use mainly as a base for lacquers.

Mention has already been made of the Reppe vinylation process which was also used[15] to prepare other vinyl ethers, mainly ethyl- and isobutyl-, for subsequent polymerization. A solution of caustic soda or potash in the alcohol concerned was used as condensing agent, the reaction being carried out at 150 to 160 °C, and under sufficient pressure to keep the alcohol in the liquid phase. Subsequent polymerizations of the ethers were carried out with acidic catalysts, such as boron fluoride in dioxan, to give synthetic plastics, lacquers and leather products.

A small semi-technical-scale plant at Höchst[16] produced some 3 tons a month of monovinyl acetylene, by passing acetylene through an acidified solution of ammonium chloride and cuprous chloride at 60 to 70 °C. The vinylacetylene was then treated with hydrogen chloride at 40 °C, and 2 atmospheres, cuprous chloride catalyst, to give 2-chloro-1 : 3-butadiene (chloroprene) which was polymerized to neoprene.

$$2CH{\equiv}CH \rightarrow CH_2{:}CH.C{\equiv}CH$$

$$CH_2{:}CH.C{\equiv}CH + HCl \rightarrow CH_2{:}CH.CCl{:}CH_2$$

Acrylonitrile was of importance to Germany as a major constituent, copolymerized with butadiene, of the oil-resisting synthetic rubber Buna N (also known as Perbunan). Its general applications in cyanoethylation reactions were also considered to offer considerable peacetime applications in synthetic chemistry. While it was generally produced from ethylene oxide and hydrogen cyanide, the Leverkusen plant[17] was making some 70 tons a month by the direct combination of acetylene and hydrogen cyanide at 70 to 90 °C in a rubber-lined tower containing a solution of cuprous chloride with sodium and potassium chlorides. This process was claimed to be cheaper than the ethylene oxide route, and a larger (200 to 250 tons a month) plant was in course of erection.

An interesting investigation[18], which had not proceeded beyond the laboratory, had been carried out in the I.G. Farbenindustrie A.G. laboratories. It was found that magnesium carbide, Mg_2C_3, could be made by passing hydrocarbon gases over magnesium at temperatures above 700 °C (below 700° MgC_2 is formed) or more conveniently, by double decomposition between magnesium chloride and calcium carbide between 600 and 700 °C. Mg_2C_3 reacts with water to give methyl acetylene, which could be converted by the Reppe carbonyl catalysts (nickel halides, nickel carbonyl) to methacrylic acid or esters, for example, methyl methacrylate:

$$Mg_2C_3 + 2H_2O \rightarrow CH_3C{\equiv}CH + 2MgO$$

$$CH_3C{\equiv}CH + CH_3OH + CO \rightarrow CH_2{:}C(CH_3)COOCH_3$$

Chlorinated Solvents

A valuable range of solvents was made by the direct chlorination of acetylene[19]. They are non-inflammable, have high penetration and are generally quite stable, and have found wide application in industry for dry cleaning, degreasing, oil extraction from seeds, and many specialized purposes.

The chemistry of the process is well-established. The first stage, the production of the unstable intermediate tetrachlorethane ($C_2H_2Cl_4$), was brought about by the direct interaction of acetylene and chlorine in a tetrachlorethane solution of ferric chloride at 70 to 90 C. This was boiled with milk of lime to give trichlorethylene (C_2HCl_3) or with iron scrap to give the isomeric dichlorethylenes ($C_2H_2Cl_2$). At Rheinfelden *trans* dichlorethylene was made by the chlorination of acetylene in the gaseous phase in the presence of activated charcoal. Trichlorethylene was also made by passing tetrachlorethane over barium chloride catalyst supported on active carbon, at 230 to 360° C. Perchlorethylene (tetrachlorethylene, C_2Cl_4) was made by the chlorination of trichlorethylene to the unstable pentachlorethane (C_2HCl_5), which was then boiled with milk of lime. Further chlorination, at 100 to 110° C, of the perchlorethylene gave hexachlorethane (C_2Cl_6). Small amounts of dichlorethylene were also made by blowing tetrachlorethane with live steam in the presence of iron.

Other Reppe Syntheses

In addition to the syntheses due to Reppe and his co-workers already enumerated there were a number of other processes of interest, though some of these had not proceeded beyond laboratory or pilot plant stage.

A modification of the final stage of the Reppe butadiene synthesis (increasing the pressure to 100 atmospheres, the temperature to 300° C and controlling the pH to 2) led to the production of tetrahydrofuran in very good yield.

$$CH_2(OH)CH_2CH_2CH_2OH \rightarrow \begin{matrix} CH_2CH_2 \\ | \\ CH_2CH_2 \end{matrix} > O + H_2O$$

This material is a starting point for a number of important syntheses,[20] such as (i) dichlorbutane (by reaction with hydrogen chloride in presence of 50 per cent sulphuric acid), (ii) adiponitrile (by reaction with hydrogen cyanide in the presence of amphoteric lead or aluminium salts), and (iii) succinic acid (by nitric acid oxidation):

$$\text{(i)}\ \begin{matrix} CH_2CH_2 \\ | \\ CH_2CH_2 \end{matrix} > O + 2HCl \rightarrow \begin{matrix} CH_2CH_2Cl \\ | \\ CH_2CH_2Cl \end{matrix} + H_2O$$

$$\text{(ii)}\ \begin{matrix} CH_2CH_2 \\ | \\ CH_2CH_2 \end{matrix} > O + 2HCN \rightarrow \begin{matrix} CH_2CH_2CN \\ | \\ CH_2CH_2CN \end{matrix} + H_2O$$

$$\text{(iii)}\ \begin{matrix} CH_2CH_2 \\ | \\ CH_2CH_2 \end{matrix} > O + 2O_2 \rightarrow \begin{matrix} CH_2COOH \\ | \\ CH_2COOH \end{matrix} + H_2O$$

About 100 tons a month of the dichlorbutane and adiponitrile were produced, and 5 tons a month of the succinic acid for use in baking powders. A small quantity of tetrahydrofuran, some 16 tons in all in 1943, was co-polymerized with ethylene oxide in the presence of ferric chloride and thionyl chloride to give lubricating oils which had high flash-point, high viscosity index and low pour point, but poor thermal stability.

A synthetic blood plasma, Periston, was made from butyrolactone by condensation with ammonia to pyrrolidone, vinylation with acetylene and polymerization of the product.

$$\begin{matrix} CH_2CH_2 \\ | \\ CH_2CO \end{matrix} > O + NH_3 \rightarrow \begin{matrix} CH_2CH_2 \\ | \\ CH_2CO \end{matrix} > NH + H_2O$$

$$\begin{matrix} CH_2CH_2 \\ | \\ CH_2CO \end{matrix} > NH + C_2H_2 \rightarrow \begin{matrix} CH_2CH_2 \\ | \\ CH_2CO \end{matrix} > NCH{:}CH_2 \quad \text{(vinyl pyrrilidone)}$$

Vinyl carbazole was prepared by reaction between acetylene and carbazole in hexahydroxylene at 140° C and 10 atmospheres, using caustic potash and zinc oxide as catalysts. The polymerized produced, known as Luvican, had a high softening point and valuable electrical properties.

Another vinylation reaction[21], of *p*-tertiary butyl phenol in the presence of zinc naphthenate at 200° C and 15 atmospheres, gave Koresin, an important adhesive for synthetic rubbers, 100 tons a month being produced.

Others, among the many interesting reactions investigated by Reppe,[16] but

not applied beyond the laboratory scale, included the polymerization of acetylene to *cyclo*octatetraene (in 70 to 80 per cent yield) and other *cyclo*polyolefins, the reduction of *cyclo*octatetraene to *cyclo*octane and its subsequent oxidation to suberic acid, the synthesis of hydroquinone by the interaction of acetylene, carbon monoxide and water in the presence of iron carbonyl, and the synthesis of trimethylvinylammonium hydroxide (neurine) by the interaction of acetylene, water and trimethylamine.

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The Reports quoted form a selection of the more important ones from the very large number dealing with acetylene chemistry.

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U.K. PETROLEUM CONSUMPTION

In the accompanying table are given the details of the quantities of petroleum products entered for home consumption in the U.K. on payment of Customs duty* in 1947, 1946, and 1938.

Although these figures do not take into account the comparatively small quantities of home-produced oils used in the U.K. they do form a good indication of actual consumption. Comparing 1947 with 1946 the most noteworthy increase is that of 326 per cent for "other fuel oil", a figure which reflects the Government's coal to oil conversion policy. Gas oil consumption in the same period increased by 32 per cent and motor spirit by about 14 per cent.

Compared with 1938—the last full year pre-war—the details for 1946 and 1947 are an indication of the general trend in post-war consumption in comparison with the pre-war period. The index figures in the table show the continued increase in the utilization of all petroleum products and particularly stress the importance of the heavier varieties of the liquid fuels.

	1947 Million gal.	Index (1938 = 100)	1946 Million gal.	Index (1938 = 100)	1938 Million gal.
LIGHT OILS:					
Motor spirit ..	1,357·3	101	1,185·5	88	1,348·4
Other sorts ..	46·2	136	41·7	123	34·0
HEAVY OILS:					
Road fuel oil ..	167·2	194	142·4	165	86·2
Other fuel oil ..	608·5	207	142·8	49	293·7
Kerosine ..	415·5	201	356·0	172	206·5
Lubricating oil ..	152·3	117	139·9	108	130·0
Gas oil	383·0	537	290·1	407	71·3
Other heavy oils	9·0	141	4·1	64	6·4
Total	3,139·0	144	2,302·5	106	2,176·5

* "Accounts Relating to the Trade and Navigation of the United Kingdom, February 1948."

SLUDGING AND CORROSION IN BENZOLE-ABSORPTION PLANTS

THE "Report on Investigation of the Benzole Technical Committee, 1942–1946, on Sludging and Corrosion in Benzole-Absorption Plants"* is a good example of co-operative research, which the Department of Scientific and Industrial Research, since its inception in 1915, has done so much to encourage. The bodies concerned, under the aegis of the Ministry of Fuel and Power, were the Department of the Government Chemist, the Fuel Research Station of the D.S.I.R., the Alkali, etc. Works Department of the Ministry of Health, the National Benzole Association, and the Technical Officers of the Ministry of Fuel and Power. Details of the setting up of the Committee and its membership are given in the "Foreword" of the Report.

During the war, the maximum production of benzole, the pre-war existing main source of toluole for the manufacture of T.N.T., and of benzene for the production of styrene for synthetic rubber and of blending agents for 100-octane aviation fuel, was of paramount importance. Some benzole is obtained from the distillation of tar, but the main source is the gas produced at coke-oven and gas works from which it is recovered by washing the gas with an oil, creosote or a petroleum oil (gas oil or spindle oil) being mainly used. As explained in the "Introduction", these oils deteriorate during use, the creosote tending to "thicken" and the petroleum oils to throw down a precipitate or sludge. This sludge, in particular, was causing considerable loss of benzole owing to its effect on scrubbing efficiency, on heat exchange, and to the necessity of closing down the plant for cleaning. Other troubles encountered were the corrosion of plants, mainly those using creosote.

* H.M.S.O. 6*s*. 6*d*. net.

The Report gives an account of the Committee's investigations of the factors on which the rate of deterioration of petroleum oils depends, the mechanism of the reactions involved, and the problem of corrosion. Owing to the many substances present in the oils during use, both those washed out of the gas and those originally present in the fresh oil that may act either as reactants or catalysts, the problem of sludging is an extremely complicated one. Although there is still much to be done before the mechanism of sludging is finally elucidated, the Committee's "Recommendations" concerning the best operating conditions were of considerable benefit to the benzole industry, and did much towards eliminating the troubles encountered. Accounts of two of the Committee's investigations, the "Analysis of Sludges" and the "Corrosive Action of Benzole-Absorption Oils" have already been published by the Society of Chemical Industry. The Report, however, gives under one cover a complete record of the work of the Committee, the various investigations and their interrelation, and of the information accumulated, and should provide a useful starting-point for further investigations.

Owing to the difficulties in the printing trade, there has been considerable delay in issuing the report, which should be of interest to coke-oven and gas works, the producers of wash oils, both those derived from petroleum and those derived from coal-tar (oil companies and tar distillers), and to benzole plant manufacturers.

An attractive booklet just issued by the M.O.R. Group of Companies is entitled "The First Ten Years" and describes and illustrates the refinery at Manchester.

[Courtesy Anglo-American Oil Co. Ltd.

THEN AND NOW

Had one looked into a Brighton garage on March 7, 1911, they might have seen this aeroplane being serviced for a flight from Brighton to Shoreham. It looks as if three cans of motor spirit was maximum capacity of the tank in these fragile machines in which the pioneers of aviation took great risks.

To-day, the modern 4-engined aeroplane would barely move on six gallons of aviation spirit and to supply its needs from 2-gallon cans would probably take longer than its journey from London to New York. The job is, however, rendered simple and rapid by the use of refuelling tank waggons. That seen below servicing a DC-4 Skymaster at Shannon Airport, Eire, has a capacity of 4300 gallons.

[Courtesy Anglo-American Oil Co. Ltd.

THE REDWOOD MEDALLIST ENTERTAINED

FOLLOWING the presentation of the Redwood Medal to Mr H. S. Gibson, C.B.E., on March 10, Members of Council of the Institute were hosts at a dinner in honour of the three Redwood Medallists: H. S. Gibson (1948), Dr A. E. Dunstan (1938), and Sir Harry R. Ricardo, F.R.S. (1936).

H. S. Gibson, C.B.E., receiving the Redwood Medal from the President of the Institute on March 10, 1948.

In the unavoidable absence of the President of the Institute the chair was taken by Mr Hugh Tett (Chairman of Council), who was supported by Mr E. A. Evans (President-Designate and Chairman, Awards Committee), T. Dewhurst (Past-President), G. H. Coxon, A. C. Hartley, J. A. Oriel (Vice-Presidents), H. Hyams, F. Morton, C. A. P. Southwell, F. B. Thole (Members of Council), E. B. Evans (Hon Associate Editor), and C. Chilvers (Hon Secretary). Mr Gibson was accompanied by Mrs Gibson and their oldest friends Mr and Mrs J. M. Pattinson, and Mr B. J. Ellis (Ministry of Fuel and Power) was also present.

MR H. C. TETT explained that the purpose of the very informal party was first to pay honour to Mr and Mrs Gibson, and secondly to provide an opportunity to meet them and to know them.

They were also pleased to welcome among their number Dr Dunstan and Sir Harry Ricardo—both Redwood Medallists whom they were proud to have with them. The Ministry of Fuel and Power was well represented in Mr Ellis and Dr Thole, the former a one-time Member of Council and the latter a present Member of Council. It was also a pleasure to see Mr and Mrs Pattinson—old friends of the Medallist and his wife.

MR E. A. EVANS: This evening we commemorate an outstanding personality in the petroleum industry—the founder of the Institute of Petroleum, Sir Boverton Redwood. Also, we pay tribute to men who have achieved great results in the intellectual field, and have become international figures.

Dr A. E. Dunstan, that ever youthful man, who has just attained "three score years and ten", and is still engrossed in editing yet another volume of *Science of Petroleum*, lecturing, and distributing gifts of understanding to his fellow creatures. He seems to have discovered the Elixir of Life, which the alchemists called *quinta essencia*. I believe that the enlightened amateur of science calls it alcohol.

'Sir Harry Ricardo, that quiet, resourceful, successful engineer, has probably made the greatest contributions to the advancement of the internal combustion engine, for which many honours have been bestowed upon him. And now, His Majesty the King has conferred upon him the accolade of Knighthood. Yet, withal, he has preserved a sensitiveness and cultural fragrance.

These are the type of men the Institute of Petroleum selects for the presentation of the Redwood Medal. Fortunately, for the Awards Committee such giants in the scientific aristocracy, who have

scorned delights to live laborious days, have lighted a beacon for all of us to see. So, when another recommendation to Council was made last year for the award of the Redwood Medal there was no difficulty in suggesting Mr H. S. Gibson.

Now Mr Gibson has surrendered his natural modesty, but only for a brief period, to come here from Iran to be lauded, and to receive from our President, Sir Andrew Agnew, the Redwood Medal. The medal is the symbol of our conviction that he has made very distinguished contributions of signal importance. So we do hope that the sight of this beautiful silver medal will assist him to revalue his achievements, even though few facts chant their own praise or excite enthusiasm at the time of their activity. I do not want to sentimentalize upon Gibson's work or the facts which have emerged from it. But if he is still a little timid about the effects of a revaluation all I can say is—when confronted with a rattlesnake it is a seldom advisable to ponder too deeply about the disposal of its skin. It is only left for me to say that to-day he has had a foretaste of immortality, for which I ask something from him—a photograph to hang in the House of the Institute with the other Redwood Medallists.

Mr Gibson, long may you have health to enjoy your new dignity.

We are particularly pleased to have Mrs Gibson here to-night, not because her husband is too feeble to stand alone or is likely to wilt under the glare of the floodlight, but because of her own natural charm and her association with the Anglo-Iranian Oil Co. since 1923, when she was appointed Matron of Ahwaz Hospital.

As a daughter of Professor James Blythe of Glasgow, she is well known to many Scots in the company, including Sir William Fraser and Mr Jameson. In 1927 she married Mr Gibson, to whom she has been of inestimable value in social affairs in Iran with all nationalities. So erudite has she become in Iranian lore that she was nicknamed "HAJI". Like Ormuzd, the spirit of good in the ancient religion of Persia, she has done much to build and cement a blissful social unity in that country. The noble work she has done makes some of us conscious of what we might have done instead of surrendering ourselves to the smells of the laboratory in preference to the odour of sanctity.

Gentlemen, I now give you the toast of the Redwood Medallists, coupling with it the name of H. S. Gibson.

MR H. S. GIBSON: I wish to thank Mr Evans for his extremely kind references to me. I am completely overwhelmed by the very great honour which has been conferred on me by the Institute, and when to-night I find myself in the presence of those giants among men, as Mr Evans has so aptly described them, who have previously received the Redwood Medal, I feel rather like a yokel who finds himself by accident at a meeting of, say, the Royal Society. For even if I do not come with straw in my hair, I have spots of crude oil on my hat, the mark the world over of an oilfield production engineer.

Mr Southwell greatly flattered me earlier on this evening by saying that I am a scientist, a title to which I have no claim whatsoever. I have often thought that the type of science applied to production engineering was well defined by a writer in *Nature* some years ago, in which he said, "Science consists of theory and experiment, theory which no one believes except the man who first thought of it, and experiment which every one believes except the man who last tried it." That is exactly the way things go on oilfields.

However, although a production engineer is not a scientist, he puts the work of scientists to practical use, in fact he is dependent on them for his progress. By encouraging both scientist and engineer and bringing them together, the Institute of Petroleum is

carrying out a vital task for the industry, a task which was clearly foreseen by the great founder of the Institute, Sir Boverton Redwood, himself both scientist and practical man of affairs, who is commemorated by the Medal which I am privileged to receive to-day.

I shall treasure this Medal the whole of my life, not only for myself, but because it will be an inspiration to other engineers concerned with the day to day operations of the oil industry.

In conclusion, I thank you, Sir, and Mr Evans, for your very kind welcome to my wife.

PETROLEUM IN PARLIAMENT

Fuel Oil Price

The Minister of Fuel and Power was asked on March 9 whether, in pursuance of the policy of preventing further rises in prices, it was proposed to fix at the present level the price of fuel oil for industrial use. The Minister, in a written reply, said that fuel oil prices were dependent upon world prices and he could not undertake that they would remain at their present level.

Civilian Oil Imports

The reason for the planned increase in civilian oil imports in 1948 compared with 1947, as shown in the Economic Survey for 1948, is partly due to increased industrial consumption of fuel oil and partly to the need to safeguard civilian stocks, said the Parliamentary Secretary to the Ministry of Fuel and Power in a written reply on March 16.

Questioned further on March 25, he said that the figures for 1948 allowed for the coal-oil conversion being carried out in full and on this basis consumption of fuel oil would be about 2½ million tons higher than in 1947. As he had announced in December, transport and supply difficulties had made it necessary to slow down the original programme.

Heysham Refinery Output

The Minister of Fuel and Power said (March 18) that the Government refinery at Heysham had been disposed of to the "Shell" Refinery & Marketing Co. The company's programme did not include the manufacture of lubricating oil since the refinery was not equipped for this purpose.

British Oil Companies in Roumania

Replying to a question on March 22 regarding the treatment of British oil companies by the Roumanian Government, the Under-Secretary of State for Foreign Affairs said the policy of the Roumanian Government appears to aim at gaining possession of British and British-owned oil companies without payment. This is being done both by accusations of "economic sabotage," and by so interfering with their commercial activities as to force them into bankruptcy. One British oil company has been instructed by the Roumanian Government to sell certain of its assets to a Soviet controlled company at prices fixed in local currency by the Roumanian Government. The Roumanian Government has appointed administrators to two British-owned Roumanian companies. The State Administrator appointed to Astra Romana, the largest oil company in Roumania, has acted in a manner so prejudical to the interests of the British majority shareholders that they recently decided to declare Astra Romana in a state of forcible dissolution and to withdraw the British staff from Roumania. The oil companies also have various causes for complaint against the Roumanian Government arising out of the Peace Treaty.

COUNCIL COMMENTARY

COUNCIL met on Wednesday, March 10, and after confirmation of the Minutes and business arising from these, proceeded to discuss a very full agenda, the first item of which was the report of the By-laws Committee. Council had considered on previous occasions the desirability of extending the membership of the Institute to include a form of company membership which would enable those companies interested in and desirous of encouraging the work of the Institute to become members of the Institute. The report of the By-laws Committee dealt with this proposal and the alteration to the by-laws necessary to achieve this end. After some discussion the recommendations were adopted and the proposed alterations to the by-laws, which will be submitted for consideration of the members at the Annual General Meeting, were placed on record available for the inspection of members.

The report of the Election Committee was approved and Council proceeded to discuss the Annual Report of Council and Council Committees submitted by the Hon Secretary. The delightful spring atmosphere outside the council chamber was affecting the Council who dealt with these important documents in a refreshing manner. Mr Dewhurst, ever on guard against pollution of the English language—an example which we earnestly wish all petroleum technologists would follow—succeeded in replacing the Hon Secretary's "Highlights of the Year" by a more sober phrase. Professor Garner's protest at the exclusion of the vice-presidents from the draft list of officers was also received with sympathy! The reports of the Council committees were approved, these showing the excellent work which has been done by the committees on behalf of members during the year.

The International Geological Congress, which is to be held in London during August, was the subject of some discussion since Council is anxious to arrange a function at which the petroleum geologists attending the Congress would meet members of the Institute and visit the Institute's premises. Although a very full itinerary has been prepared by the officials responsible for the Conference, it is hoped that time will permit of such a function being arranged.

The Council heard with satisfaction a report of the very successful inaugural meeting of the London Branch and approved the action taken by the founder members. The Chairman of Council was asked to convey to Mr Hitchcock and Mr Goodfellow the Council's appreciation of their efforts. It is hoped that the London Branch will attract a wide membership and will cater particularly for the non-technical personnel of the oil industry situated in the London area.

The spring feeling was still evident when the Chairman of the Northern Branch indulged in a little (justifiable!) flag-waving over the success of two branch members in winning the bronze medal of the City and Guilds. The Northern Branch had been largely responsible for the introduction of a course in petroleum technology and had provided one of the lecturers in the course. Council expressed its satisfaction at the results obtained and congratulated the Northern Branch on this further evidence of its keenness. What can be said of the base individual who suggested the students might well have outstripped the lecturer (on a company basis!) except to remark that oil men are the same the world over and their friendly competitive spirit would be sadly missed in a world of ever increasing regimentation.

The forthcoming visit of two A.S.T.M. officials to Britain for discussions with Sub-Committee No. 1 of the Standardization Committee was welcomed by

Council, and Mr. Hyams was congratulated on the excellent work of this sub-committee on measurement of oil. The interest of A.S.T.M. in the work of the Standardization Committee and the close co-operation which exists between the various sub-committees of the two organizations is a matter of considerable satisfaction to Council.

After a brief discussion on the report of the House Committee and consideration of the arrangements made for the Annual General Meeting, Council proceeded downstairs in the hopes of enjoying a well-earned tea. The great attraction of a lecture by the Redwood Medallist had, however, brought so many members to Manson House that few if any Council members succeeded in reaching the festive board!

THE POLISH PETROLEUM INDUSTRY IN 1947

By A. FRIEDMANN*

In 1947 a total of 128,000 tons of crude oil, 6000 tons of natural gasoline and 148,000,000 cu.m. of natural gas were produced in Poland. Some gasoline was exported but the entire output of petroleum coke was disposed of in the home market. The output target was exceeded in all branches of production, although it had been fixed at a rather high level.

The year was marked by a steep increase in the output of gasoline and an increase in drillings.

On some occasions in the second half of the year, the daily output of crude oil and gasoline reached nearly 400 tons—about 40 per cent of Poland's average daily consumption. With benzole and home-produced alcohol added, the home requirements were covered to the extent of 40 per cent.

The output of crude oil in the old provinces can best be assessed by comparing the ratio of oil obtained to the meterage drilled. In 1947, this ratio was 7 tons of oil per one metre drilled, compared with 3·7 tons of oil per metre in 1932. These figures are a proof of the rational exploitation policy of the Polish petroleum industry. The old methods of costly drillings have been abandoned, and cheaper methods adopted. Drillings were made in hitherto unexploited areas. The Prospecting Department can also claim exceptionally good results. In 1946/47 about £1,250,000 were spent on prospecting. New natural gas deposits were discovered near Debowiec, containing about 3,000 million cu.m. of natural gas, of an estimated value of £15,000,000, as well as smaller deposits near Mielec, of which the value is difficult to assess at present.

At Klodawa near Kutno, sodium, magnesium, and potassium salts were discovered by chance and their exploitation value will be assessed in 1948. At Roztoki, a new gasoline plant was built.

A pipeline leading from Debowiec to Cracow, 105 km long, was completed in 1947. Tests made late in the year proved that natural gas could be used for research experiments at Oswiecim and for domestic purposes at Cracow, Tarnow, and even in localities up to Sandomierz in the north-west. The pipeline supplied 100,000 cu.m. of gas per day, which for domestic purposes was equal to 200,000 cu.m. of coke gas.

At Grybow near Nowy Sacz, bituminous shale was discovered, containing 8 per cent of combustible material, and

* Attaché, Polish Embassy, London.

considerable quantities of sulphur greatly needed for chemical factories.

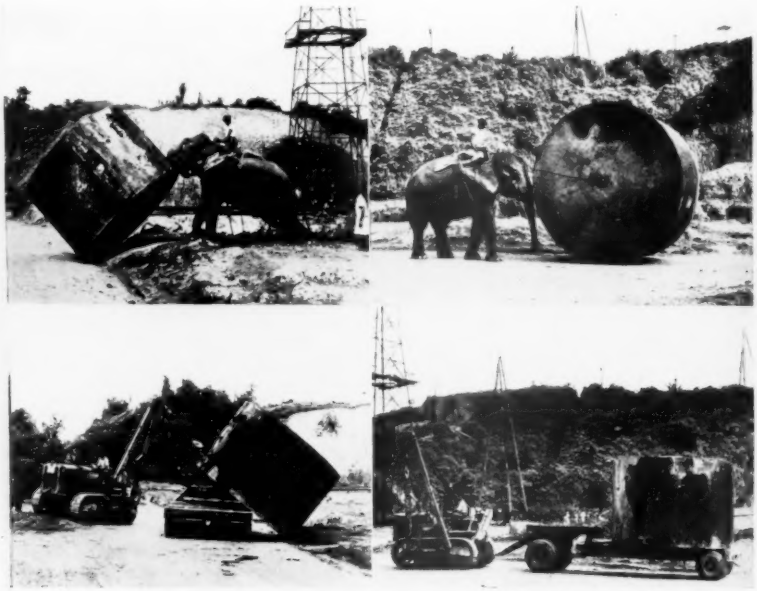
Polish refineries processed 168,000 tons of crude oil, of which 40,000 tons were imported in 1947, and the quality of their products was much higher than in 1946.

The Central Petroleum Trading Office increased considerably the number of its warehouses, doubled the number of gasoline pumps and extended installations for unloading oil and its products in the ports of Gdynia and Gdansk.

In order to make economies, a number of natural gas burners were installed throughout the country.

The profits of the petroleum industry were larger than in 1946, and considerable sums could be paid as instalments for amortization.

Summing up, it may be said that the years 1945 to 1947 were doubtlessly the most difficult for the industry because, although war damage had to be made good and new principles of work introduced, a basis had simultaneously to be created for a future planned development. Now it may be claimed with confidence that in the "old" territories the output of crude oil and of natural gasoline will further increase. Supplies of natural gas will exceed the demand, even if the gas pipeline is extended up to Radom in Central Poland, and in 1949 the pipeline will be further extended to reach Warsaw.



[Courtesy Petroleum Information Bureau

Contrasts in transport as seen in the Digboi Fields of the Assam Oil Co. Ltd.

TRINIDAD BRANCH

At the Twentieth Annual General Meeting of the Trinidad Branch of the Institute it was reported that membership at the end of the 1947 session was 86, compared with 89 a year before, and it was with regret that the deaths of three members—N. Betancourt, F. E. Hunter, and J. W. Knights—were recorded.

During the Session four meetings were held with an average attendance of 28 members and guests. Contributions from members of the Branch to the Benevolent Fund of the Institute were $77.50 and a drive is to be made to augment the Branch's contributions.

The Committee elected for the 1948 Session consists of F. C. Hamilton, P. E. T. O'Connor, H. W. Reid, J. E. Smith, S. J. Sutton, H. C. H. Thomas, C. C. Wilson. At a subsequent meeting of the Committee, Dr J. E. Smith was elected chairman and J. S. Collcott honorary secretary.

The Chairman of the Trinidad Branch, speaking at the annual dinner in 1947, mentioned that Pointe-a-Pierre had a new filling station "where one is even lured to fill up with gasoline in the hope of a glimpse of Carmen Miranda on the balcony".

The Institute of Fuel invites competition for the Students' Medal for 1948. The medal, which is awarded for an original paper on the preparation or utilization of fuel, or an allied subject, carries with it a prize of books or instruments to the value of £5. The Competition is open to Student Members of the Institute of Fuel and students of any university or technical or other college in the U.K. who are under 25 years of age. Papers should be submitted under a *nom de plume* not later than September 1, 1948. Further particulars are obtainable from the Secretary, Institute of Fuel, 18 Devonshire Street, London, W.1.

MIDDLE EAST CRUDE OILS

By L. C. STRANG*

With the increasing demand for petroleum products, the rising production of Middle East crude oils and the reported construction of pipelines from the oilfields to the Eastern Mediterranean in view, it seems likely that many of the rehabilitated and new refineries of Western Europe will process crude oil from the Middle East in place of that from the Western Hemisphere. The purpose of this paper is to discuss the products from the Middle East crude oils, and briefly compare them with those from the Western Hemisphere crude oils (Caribbean area).

The major oilfields of the Middle East are those of Iran, Iraq, Saudi Arabia, and Kuwait, and it is from these fields that export crude oil is likely to be obtained. These crude oils, although differing among themselves, are all of the same type, being classified as "Intermediate—Wax Bearing" by the U.S. Bureau of Mines method R.I. 3279 (1935). They are all at the paraffinic end of the "Intermediate" scale and are all of relatively high sulphur content.

Assessments of the above crude oils by Hempel distillations (U.S. Bureau of Mines Bulletin 207) are summarized as follows:

	Haft Kel, Iran	Gach Saran, Iran	Kirkuk, Iraq	Damman, Saudi Arabia	Kuwait
Sp. gr. at 60 F	0·836	0·866	0·844	0·852	0·860
Sulphur, per cent	1·2	1·6	2·0	1·6	2·2–2·5
Hempel Distillation	Volume per cent				
Light gasoline	10·1	9·7	11·3	8·0	9·1
Gasoline plus naphtha	33·6	28·2	32·8	30·0	28·7
Kerosine distillate	11·5	9·0	15·7	11·8	8·3
Gas oil distillate	19·9	16·5	14·0	21·8	16·6
Non-viscous lub. distillate	10·5	9·3	9·9	11·4	9·5
Medium lub. distillate	3·2	3·4	2·6	4·4	3·6
Viscous lub. distillate	—	—	—	—	—
Residue	20·8	32·4	23·8	20·4	31·9
Loss	1·5	1·3	1·2	0·7	1·4

Thus from the volatility standpoint the product distributions of all these crudes are not widely different, the extremes being represented by the two Iranian crude oils given, viz., Haft Kel and Gach Saran. The crude oil from other major Iranian fields is also intermediate in volatility between these two.

The crude oils from the Caribbean area vary very considerably and it is possible to make only a very broad comparison with the Middle East crude oils. In general, however, the Caribbean oils are naphthenic, most of them are of low sulphur content (0·2 per cent) and many are free from wax and contain little bitumen.

Quality of Straight Run Distillation Products

Gasolines

The paraffinic nature of the above Middle East crude oils is illustrated by the low octane number of the straight run gasoline (46 to 50 CFR.MM. for 185 C. end point gasoline). This disadvantage can of course be overcome by thermal reforming operations for high octane number gasoline production. The straight run gasolines contain small amounts of alkyl mercaptans and sulphides and require refining by conventional means such as acid and plumbite treatment. The Middle East crude oils show variation among themselves in this respect, the gasoline from Kuwait crude oil for example containing only traces of mercaptan sulphur. The gasolines up to *ca* 150 C. end point vary in aromatic content over the range 5 to 9 per cent (benzene, toluene, xylenes, and ethylbenzene).

Compared with the above, gasolines from the Caribbean area have higher octane numbers and require less refining treatment.

* Anglo-Iranian Oil Co. Ltd.

Kerosines

Kerosines obtained by distillation from the Middle East crudes contain about 18 per cent vol of aromatic hydrocarbons and have a smoke point of 20 to 23 mm. By extraction with solvents, such as sulphur dioxide, very good burning soils may be obtained, while the highly aromatic extracts are valuable components for motor fuels and tractor vaporizing oils. Like the gasolines, the kerosines contain small amounts of mercaptans, and require sweetening treatments such as acid or plumbite in addition to solvent extraction. Burning oils of lower quality may be obtained by acid treatment alone, without solvent extraction.

Gas Oils and Diesel Oils

Owing to their paraffinic nature the gas oils obtained from Middle East crudes have high cetane numbers (*ca* 56) and hence are very valuable as fuels for high-speed diesel engines. For the usual gas oil boiling range the sulphur contents vary from 0·65 up to 1·0 per cent wt dependent upon the crude oil. They have satisfactory viscosity and pour point characteristics. Compared with gas oils from the Caribbean area these gas oils have higher cetane numbers and in general have higher sulphur contents.

Lubricating Oils and Waxes

The lubricating oil portion of Middle East crude oil is waxy and of low viscosity index, but by conventional dewaxing, solvent extraction, and clay finishing treatments lubricants of high V.I. and good colour and stability may be obtained. These lubricants range in viscosity from light spindle oil to heavy cylinder stock. Commercial grades of paraffin wax may be obtained by conventional means.

Bitumens

Bitumens may be obtained from Middle East crude oils either by vacuum distillation, or by propane deasphalting short residues for the production of bright stocks. The yields depend upon which Middle East crude is used, varying from 8 to 23 per cent vol for bitumens of penetration 80 to 100 at 25° C. In general bitumens of given penetration obtained from Middle East crudes have low softening points but this can be adjusted by air blowing.

Fuel Oils

It has been pointed out that the gas oil obtained from the Middle East crudes is of high quality and hence it is usually desirable to restrict its use in fuel oils to a minimum. The residues obtained from the crudes after complete removal of the gas oil by distillation are waxy and of high viscosity. Improved quality may be obtained by subjecting such residues to thermal treatments, such as viscosity breaking, or thermal cracking of the wax distillate portion or a combination of the two processes.

Suitable fuel oils may of course also be obtained by blending the residues with some gas oil, kerosine or other diluent available from other refinery processes.

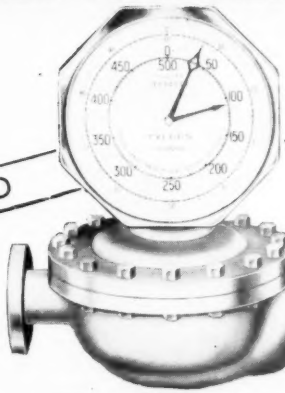
Other Processes

It has already been mentioned that the relatively low octane number of the straight run gasoline may be improved by the use of thermal reforming. Satisfactory motor spirit may be obtained by blending straight run gasoline with cracked spirit produced by thermal reforming of naphtha or cracking of wax distillate.

Heavy gas oil or wax distillate fractions are satisfactory feedstocks for catalytic cracking processes for the production of high octane number gasolines.

It is seen from the above that the Middle East crudes are well balanced in respect to their light and heavy components, and that a wide variety of satisfactory products may be obtained from them by modern refinery practice.

VOLUMETERS FOR OIL, PETROL AND OTHER PETROLEUM PRODUCTS



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PERSONAL NOTES

Our congratulations to *Dr G. M. ..ees*, M.C., D.F.C., F.Inst.Pet., on his being elected a Fellow of the Royal Society. The citation states that he is "distinguished for contributions to stratigraphical and structural geology, particularly in relation to oilfields."

John Lamb, O.B.E., manager of the Marine Department of the Anglo-Saxon Petroleum Co. Ltd., has been awarded the Gold Medal of the Institte of Marine Engineers for his paper on "The Burning of Boiler Fuels in Diesel Engines."

Prof. V. C. Illing, F.R.S., F.Inst.Pet., and *Dr G. D. Hobson*, A.M.Inst.Pet., have been appointed Chairman-Designate and Secretary respectively of Section E (The Geology of Petroleum) of the XVIIIth Session of the International Geological Congress, which is to be held in London from August 25 to September 1, 1948.

W. Fowler, of the Liverpool Laboratory of C. C. Wakefield & Co. Ltd., and a member of our Stanlow Branch, has been awarded the Bronze Medal in the 1947 Intermediate Examination (Petroleum and Petroleum Products) of the City and Guilds of London Institute.

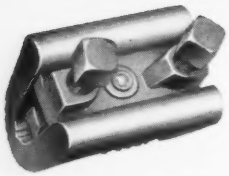
FORTHCOMING MEETINGS

INSTITUTE MEETINGS

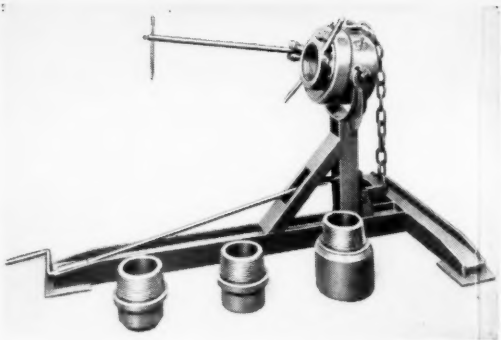
Fms of the Petroleum Industry. At 26 Portland Place, London, W.1, 5.30 p.m. (Tea 5 p.m.), May 12.

NORTHERN BRANCH

Annual General Meeting. At Engineers' Club, Manchester, May 10.



TWO BOLT POLISHED ROD GRIP



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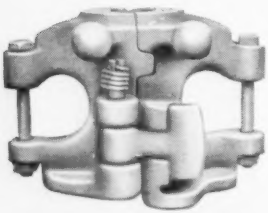

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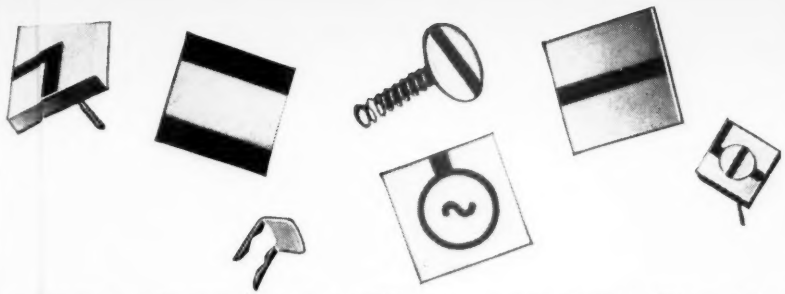

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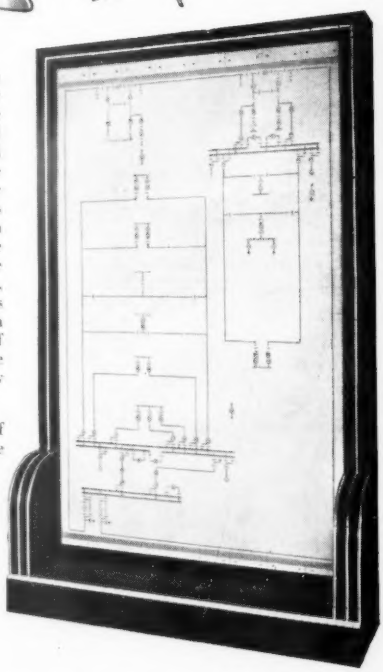

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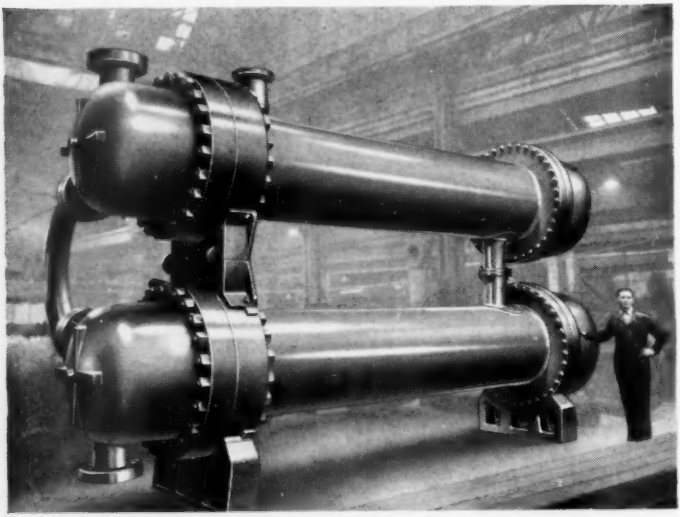

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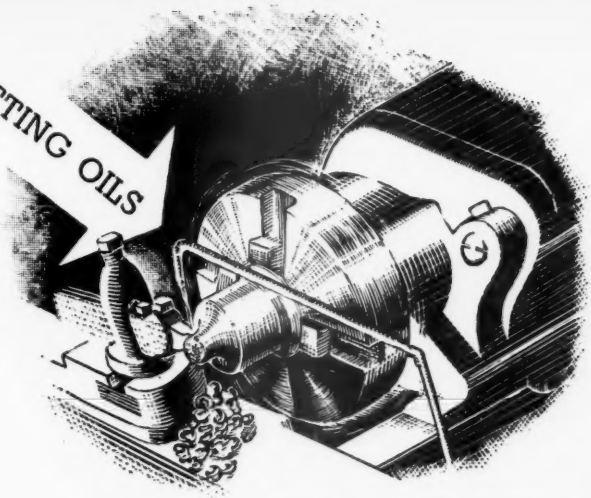

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